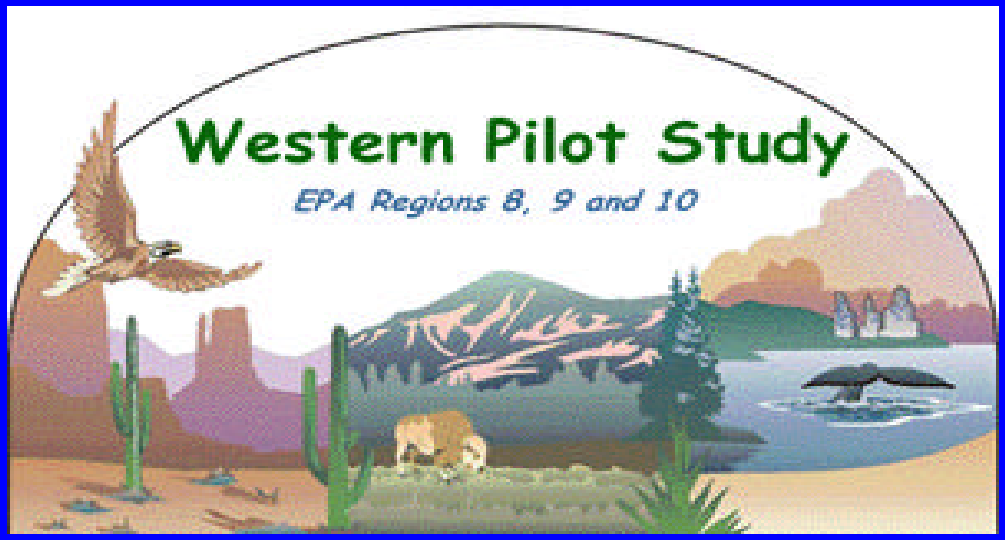
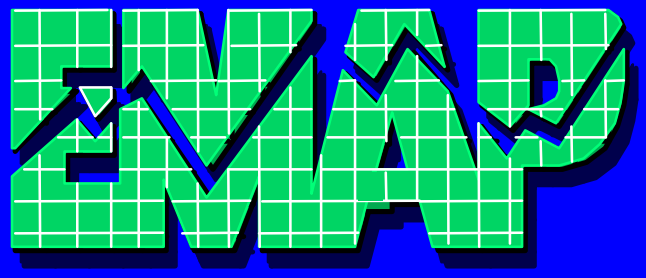


The Western EMAP Approach to Assessment of Coastal Ecological Condition

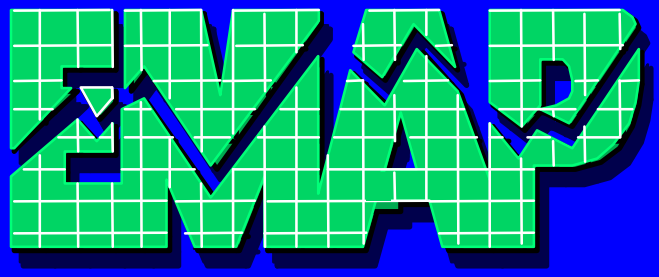
Walt Nelson
Pacific Coastal Ecology Branch, Western Ecology Division
National Health and Environmental Effects Laboratory
U.S. EPA



ENVIRONMENTAL MONITORING AND ASSESSMENT PROGRAM

NATIONAL COASTAL ASSESSMENT (COASTAL 2000)

WESTERN COASTAL EMAP



Goal

Build the scientific basis, and the local, state and tribal capacity, to monitor for status and trends in the condition of the Nation's coastal ecosystems.

NATIONAL COASTAL ASSESSMENT (COASTAL 2000) & WESTERN COASTAL EMAP

- use a unified QA/QC approach to achieve high data quality standards

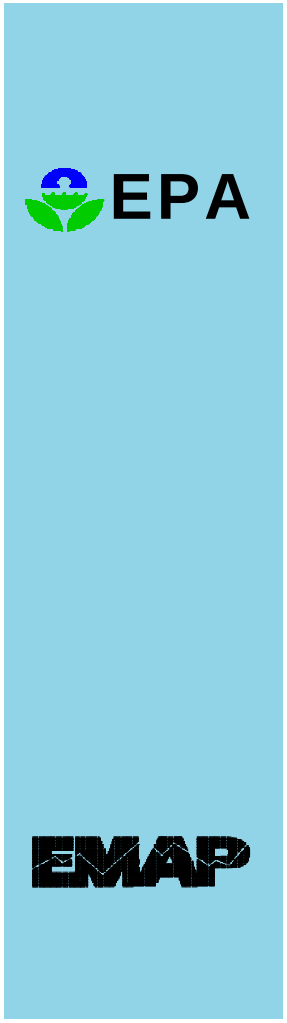
- use a standard, probabilistic approach to sampling design

- use a common approach to data analysis

- use a standard set of indicators of environmental condition, supplemented for individual study elements

WESTERN COASTAL EMAP SAMPLING PROGRAM

1999	Small estuaries of WA, OR, CA
2000	Large estuaries of WA, OR, CA
2001	Data workup
2002	Coastal systems of HI, South Central AK
2002	Estuarine tidelands of WA, OR, CA
2003	Continental shelf of WA, OR, CA



United States Environmental Protection Agency

Office of Research and Development Washington, DC 20460

DRAFT EPA/xxx/xxx/xxx April 2000

National Coastal Assessment Coastal 2000

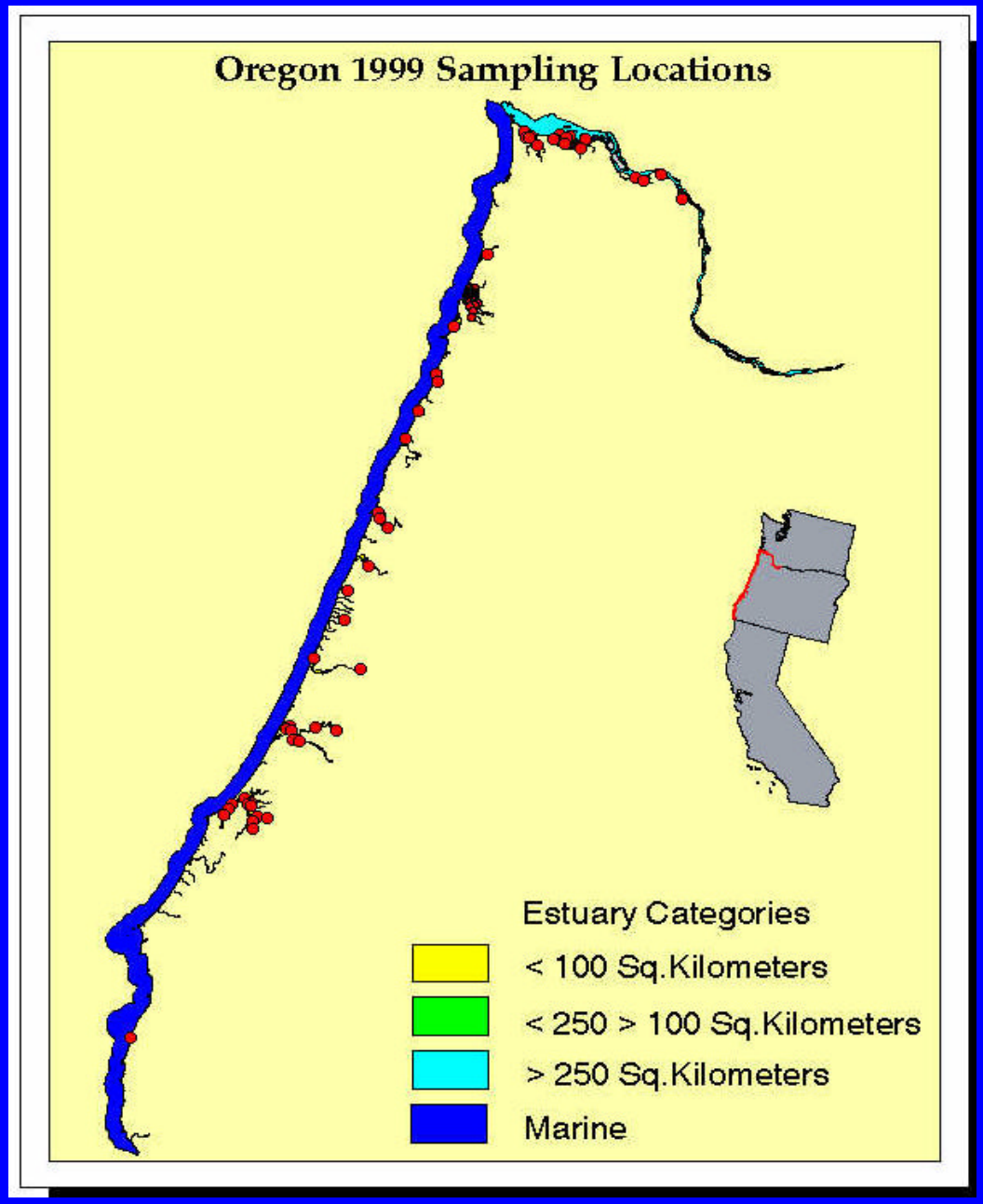
Quality Assurance Project Plan - 2000

Environmental Monitoring and Assessment Program

National Coastal Assessment QA plan used by Western Coastal EMAP

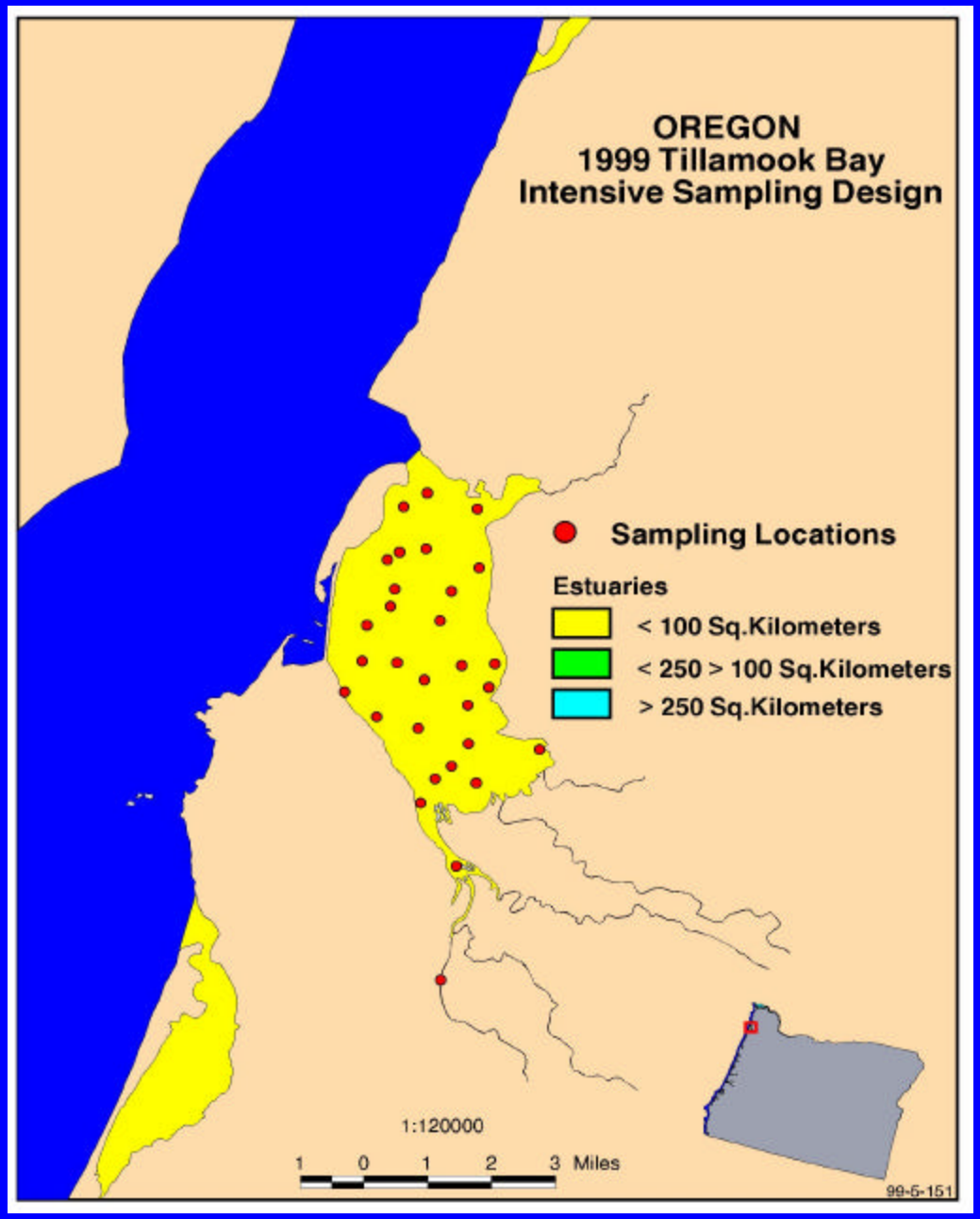
Western Coastal EMAP Multiyear Effort with Integrated Sample Design

1999 Oregon Design
- **Small estuaries**
- **Side channels of Columbia**
- **Tillamook Bay intensification**

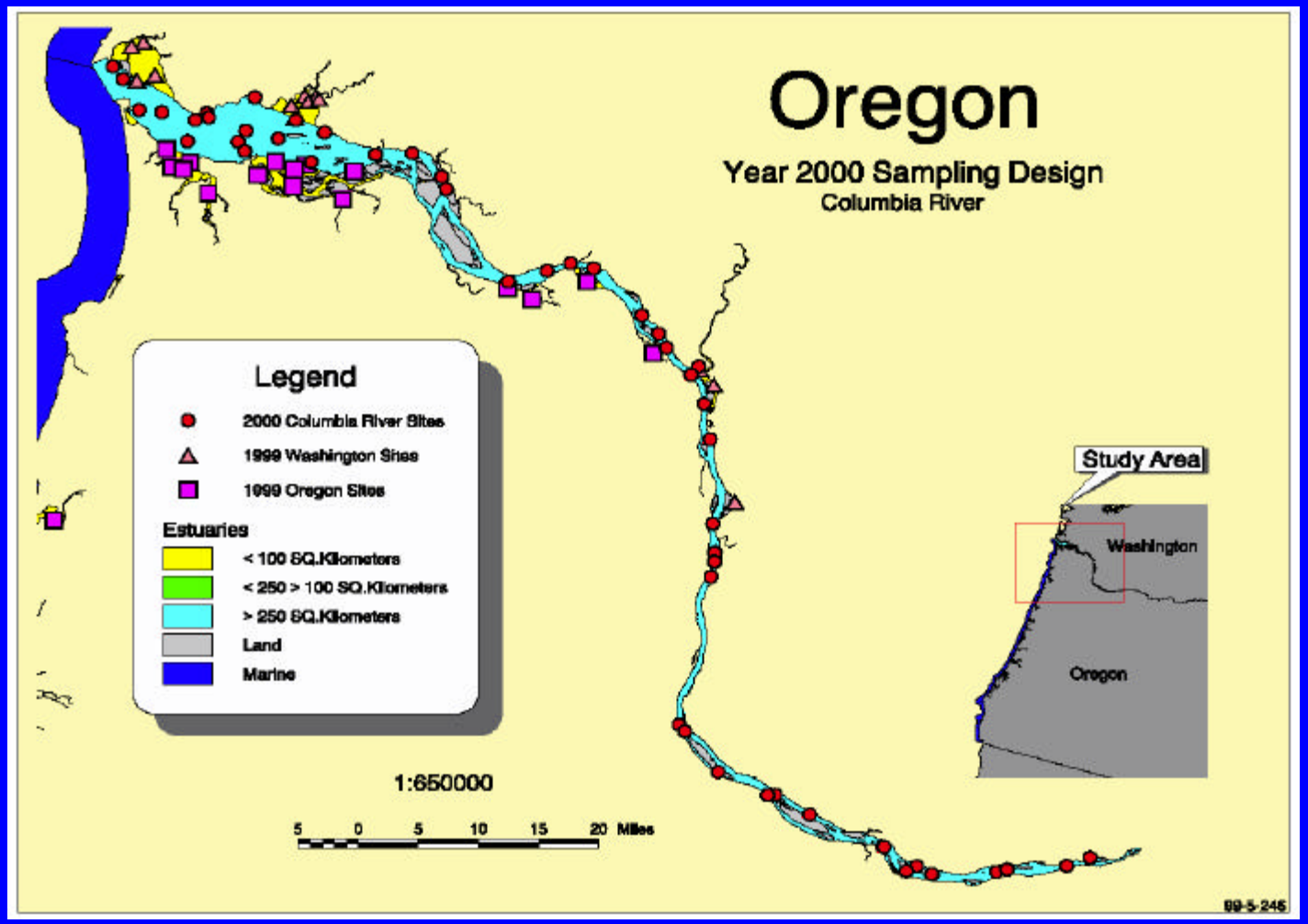


Western Coastal EMAP Multiyear Effort with Integrated Sample Design

Tillamook Bay Intensification



Western Coastal EMAP - 2000 Columbia River Sampling
Two sampling units - estuary to head of salt;
river to head of tide



2002 Western Coastal EMAP Intertidal Survey Design

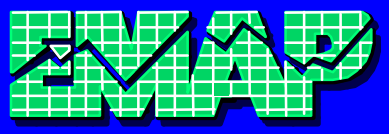
All West Coast Estuaries
(Except Columbia River)

Between 0 M (MLLW) and MHW

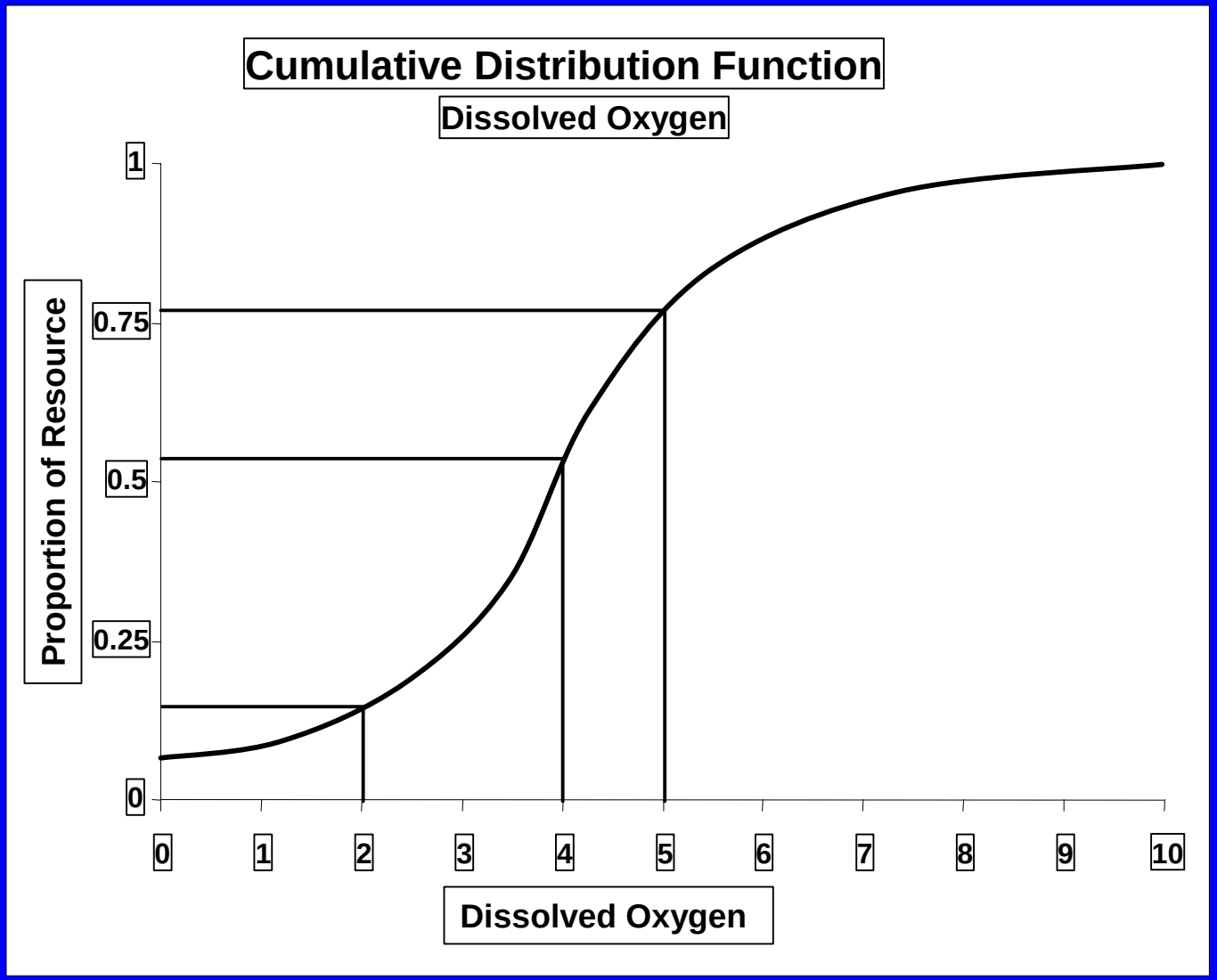
Includes Tideflats and Low Salt Marsh, Excludes High Salt Marsh

Standard NCA-Western Coastal EMAP Condition Indicators

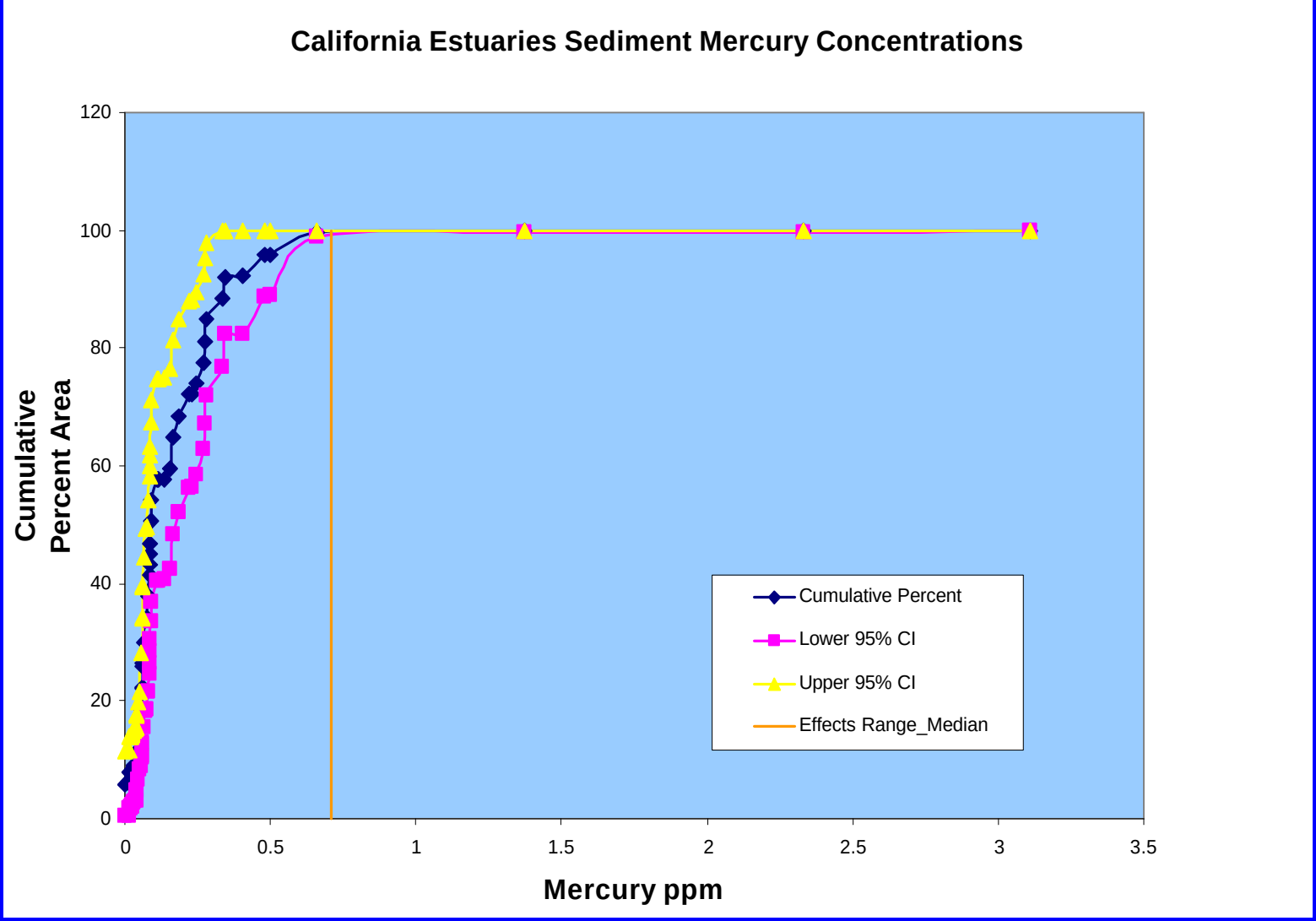
Water Column	Sediments	Biota
Dissolved Oxygen	Grain Size	Benthic Community Structure & Abundance
Salinity, Temperature, Depth	Total Organic Carbon	Fish Community Structure & Abundance
pH	Sediment Chemistry	Fish Pathologies
Nutrients	Sediment Toxicity	Fish Tissue Residues
Chlorophyll		Submerged Vegetation



Analytical Approach

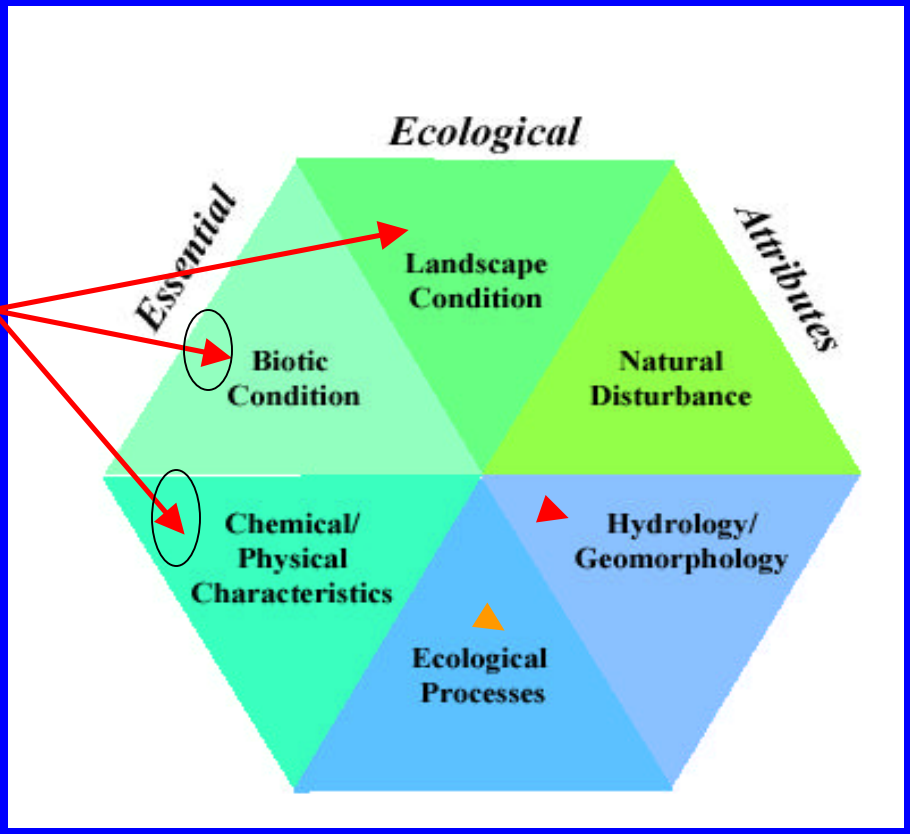


1999 Survey of California Small Estuaries



A Framework for Assessing and Reporting on Ecological Condition

From: SAB 2002



Western EMAP Coastal

2002 Intertidal Survey - CA

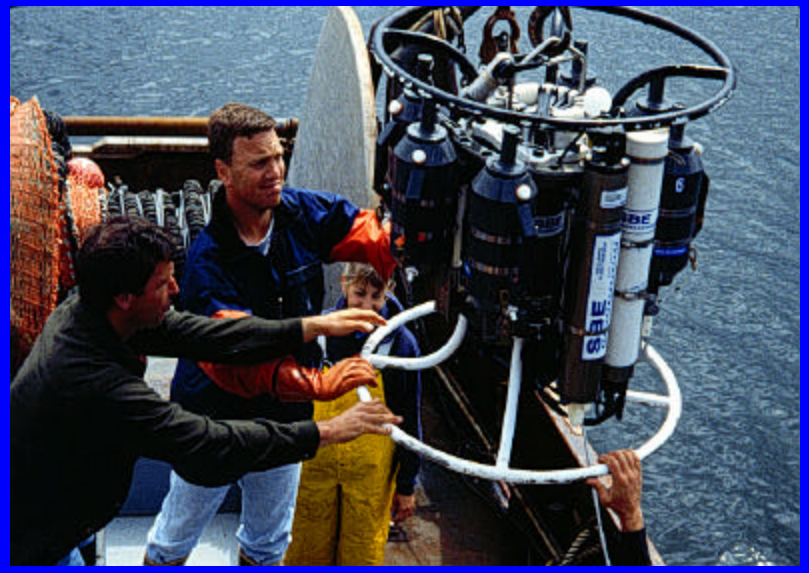
Research Effort

Chemical and Physical Characteristics

Dissolved Oxygen
Salinity / Conductivity
pH
Temperature
Water Depth
Sediment Particle Size

Nitrogen Species
Phosphorus Species
Chlorophyll

Total Suspended Solids
Transmittance (PAR)
Secchi Disk Depth



CTD and water bottle array,
Puget Sound 2000

Biotic Condition

Benthic Community Composition
Benthic Community Abundance
Fish Community Composition
Fish Community Diversity

Emergent Macrophyte Species Richness, Diversity and Density
SAV or Macroalgal Percent Cover
SAV Shoot Length

2002 West Coast Intertidal Survey

West EMAP fish sampling in 2000, Puget Sound deep stations

Western EMAP Coastal

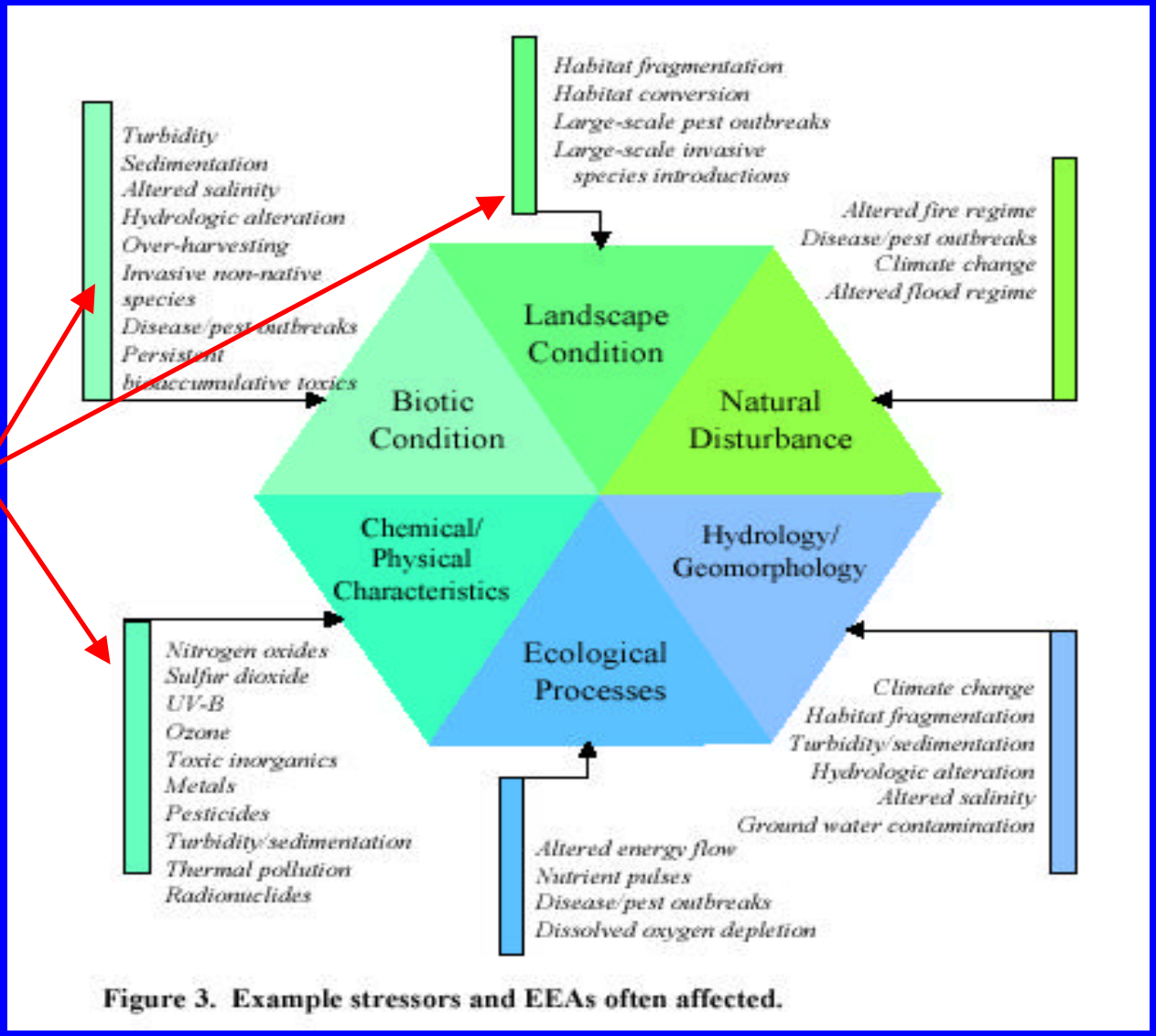


Figure 3. Example stressors and EEAs often affected.

From: A Framework for Assessing and Reporting on Ecological Condition, SAB 2002

Contaminant Loadings

Sediment Contaminant Concentrations

- Metals
- Organic Compounds

Tissue Contaminant Concentrations

- Metals
- Organic Compounds

Contaminant Effects

Fish Pathologies

Toxicological Bioassays

- Amphipod Bioassay
- Sea Urchin Bioassays (USGS)

Biotic Community Alteration

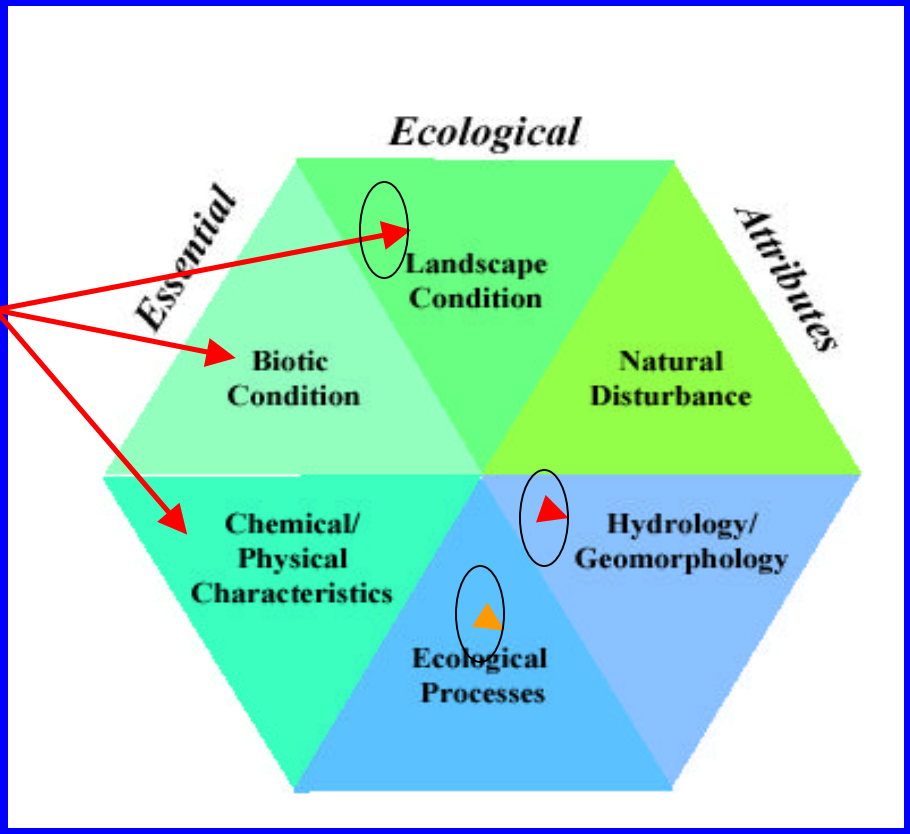
Nonindigenous Species

Bacterial Concentrations - Hawaii

A Framework for Assessing and Reporting on Ecological Condition

From: SAB 2002

Western EMAP Coastal



2002 Intertidal Survey - CA

Research Effort

Hydrology/Geomorphology

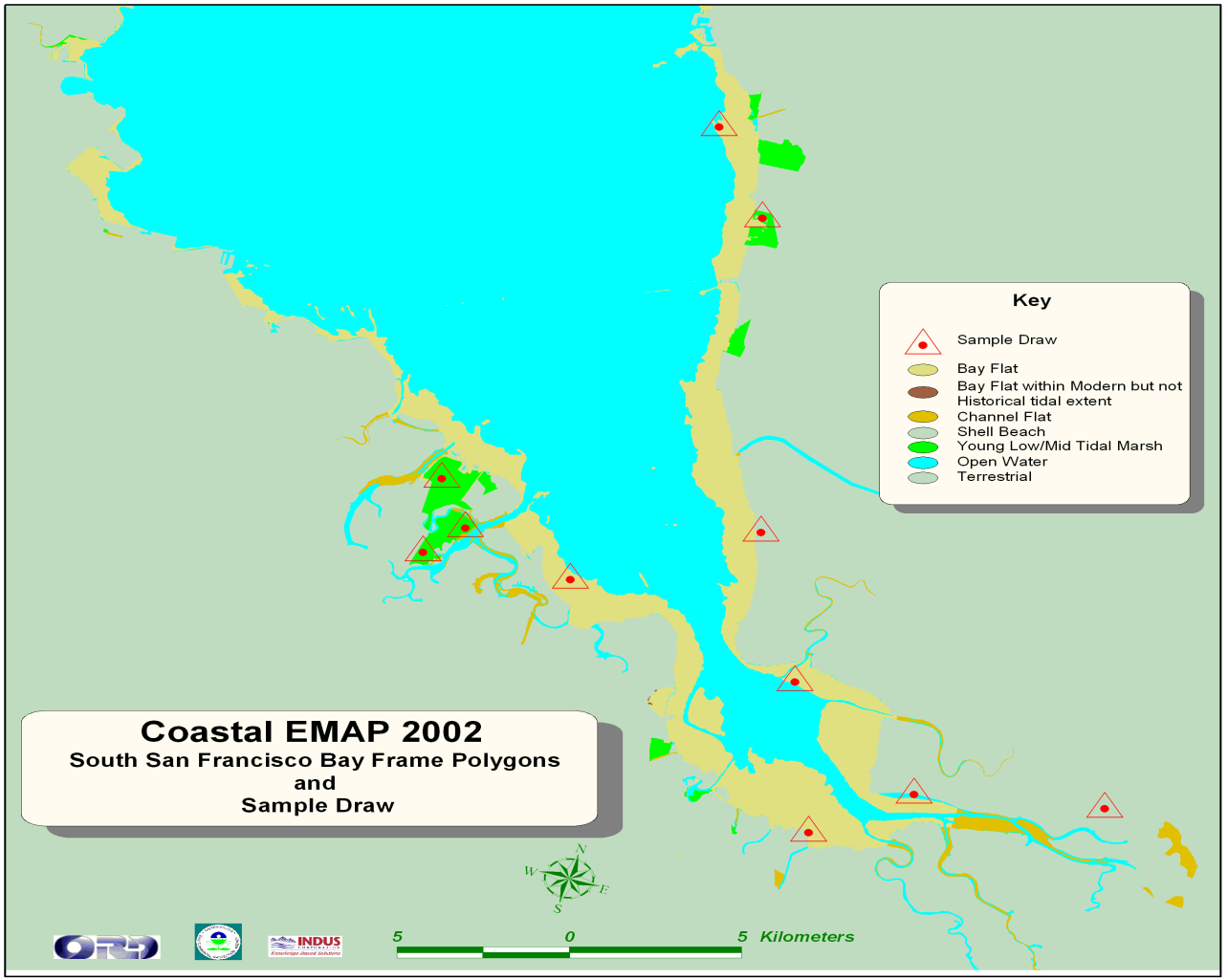
Presence of Man Made Water Control Structures and Levees

Total POTW, Industrial and Power Plant Discharge to Wetland Watershed

Percent Attenuation of Spring Tide Range

Percent of Expected Channel Density

2002 West Coast Intertidal Survey



Stratification by Habitat with Integration of Landscape Indicators

Landscape Condition

Ratio of Tidal Flat to Tidal Marsh

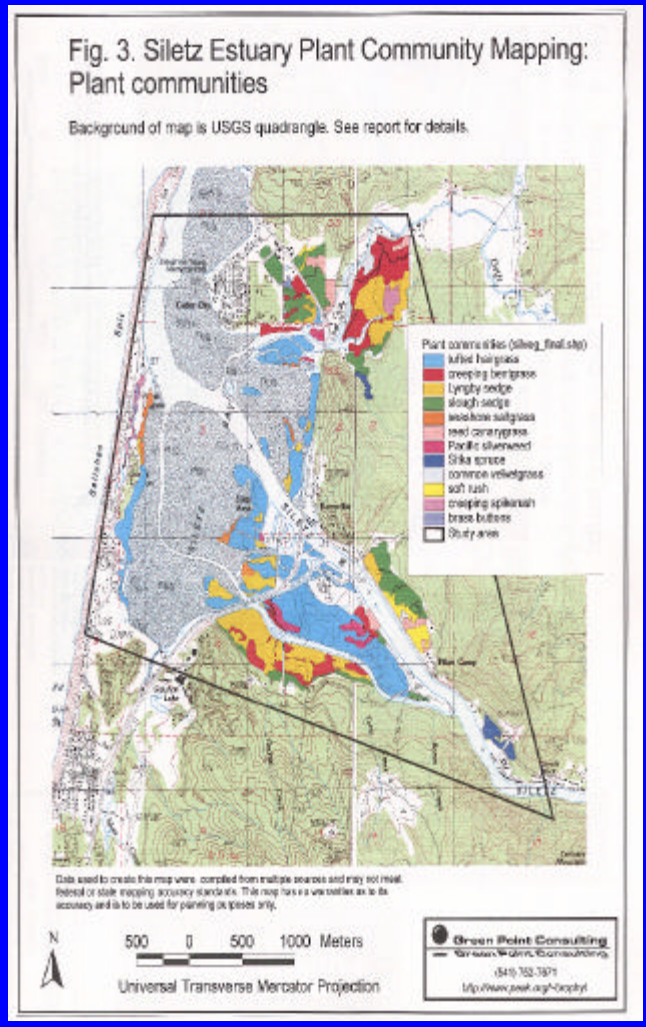
Patch Size Frequency Distribution of Tidal Marsh

Connectivity of Tidal Marsh Patches

Marsh Edge:Area Ratios

Percent of Land Border Undeveloped

2002 Intertidal Study - only for San Francisco Bay and Southern CA

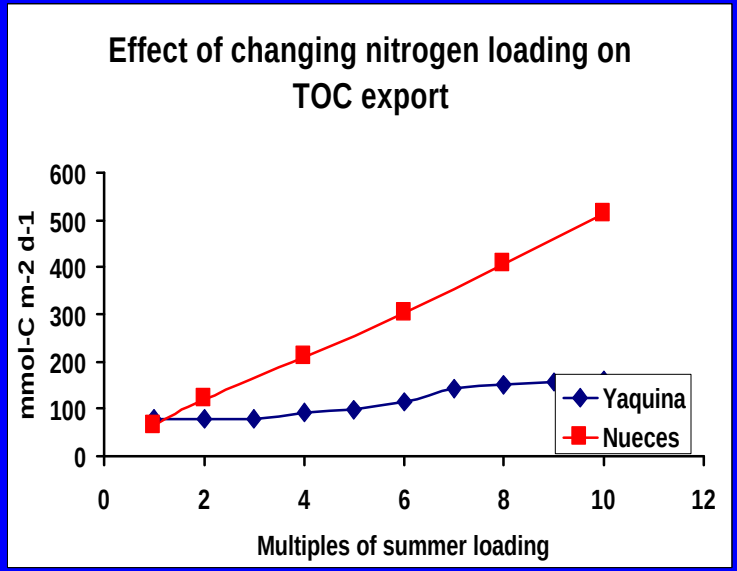


Ecological Processes

Material Flow

Food Web Flows (Carbon, Nitrogen) at Habitat and Ecosystem Levels

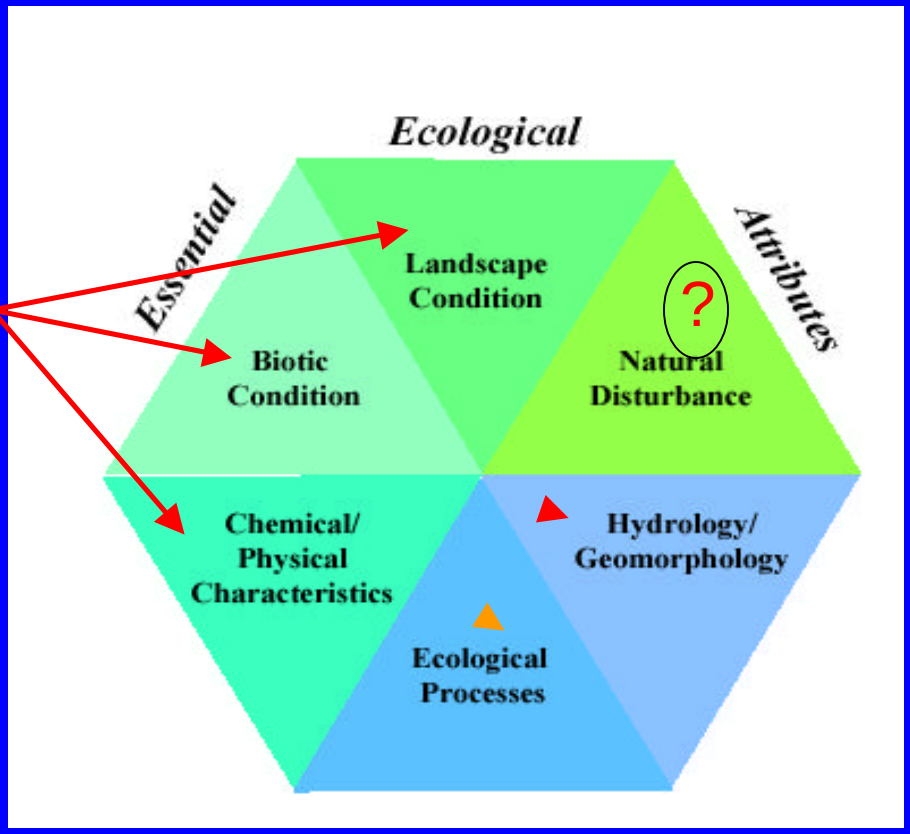
Developmental



A Framework for Assessing and Reporting on Ecological Condition

From: SAB 2002

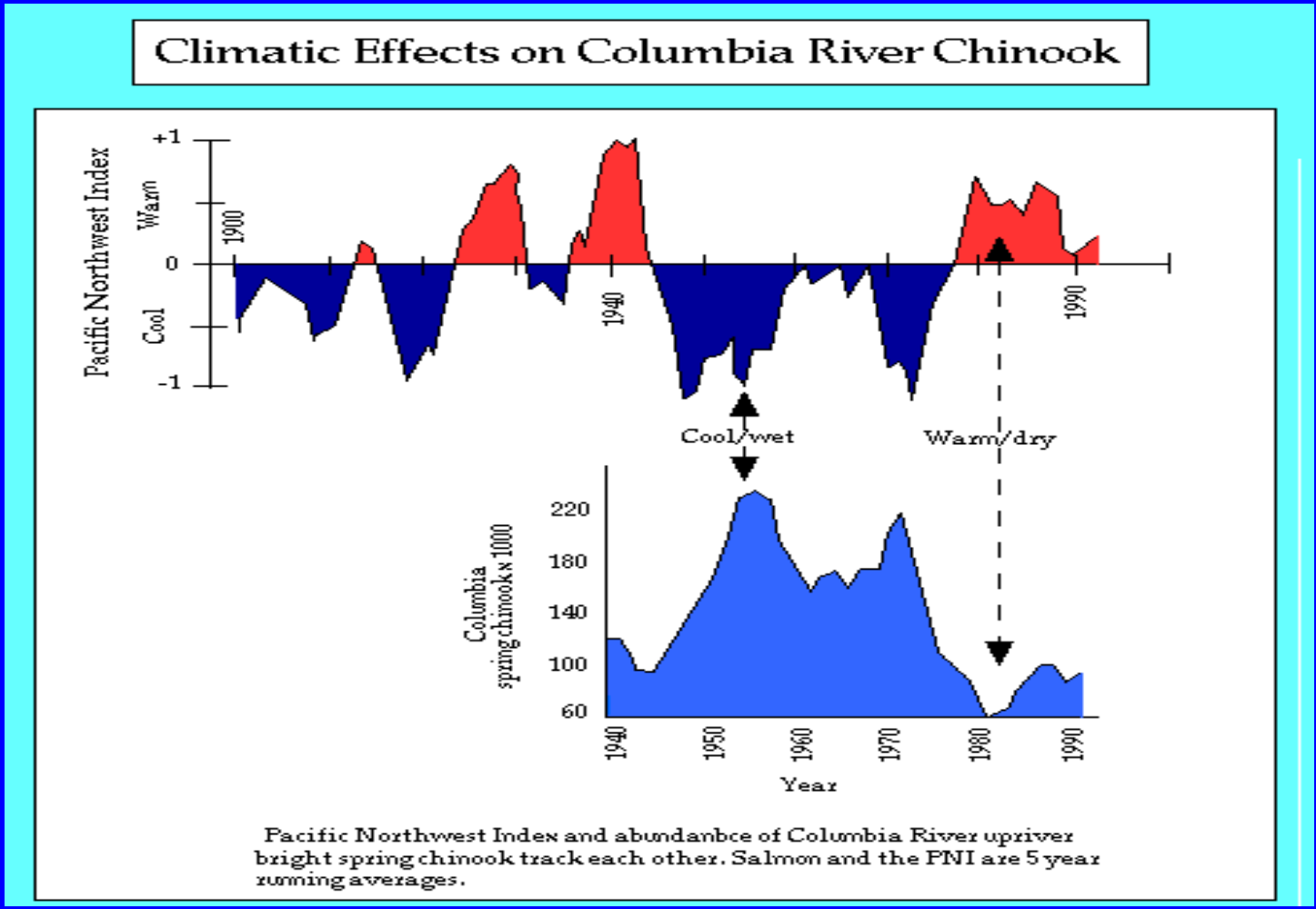
Western EMAP Coastal



2002 Intertidal Survey - CA

Research Effort

Natural Disturbance Regimes and EMAP Assessments



Long-term Climate Trends and Salmon Population
George H. Taylor, Chad Southards
1997, http://ocs.orst.edu/reports/climate_fish.html

Summary

Western Coastal EMAP

- Was initiated with a major focus on indicators of sediment quality
- Has primarily utilized indicators of biotic condition, physical and chemical characteristics, and exposure to pollutants
- Is evolving to include indicators of landscape condition and hydrology
- Needs to explore inclusion of indicators of ecological processes
- Needs to include include natural disturbance regimes in long term monitoring designs